

# Water Walls: Highly Reliable and Massively Redundant Life Support Architecture

Completed Technology Project (2012 - 2013)



## Project Introduction

WATER WALLS (WW) takes an approach to providing a life support system, Forward Osmosis (FO), that is biologically and chemically passive, using mechanical systems only for plumbing to pump fluids such as gray water from the source to the point of processing. Each cell of the WW system consists of a polyethylene bag or tank with one or more FO membranes to provide the chemical processing of waste. WATER WALLS (WW) takes an approach to providing a life support system that is biologically and chemically passive, using mechanical systems only for plumbing to pump fluids such as gray water from the source to the point of processing. The core processing technology of Water Walls is FORWARD OSMOSIS (FO). Each cell of the WW system consists of a polyethylene bag or tank with one or more FO membranes to provide the chemical processing of waste. WW provides four principal functions of processing cells in four different types plus the common function of radiation shielding: 1. Gray water processing for urine and wash water, 2. Black water processing for solid waste, 3. Air processing for CO<sub>2</sub> removal and O<sub>2</sub> revitalization, 4. Food growth using green algae, and 5. Radiation protection to the crew habitat (all cells).

## Anticipated Benefits

The Water Wall concept proposes a system for structural elements that provide, thermal, radiation, water, solids and air treatment functions which are placed at the periphery of inflatable or rigid habitats. It also provides novel and potentially game changing mass reduction and reuse options for radiation protection. The approach would allow water recycling, air treatment, thermal control, and solids residuals treatment and recycling to be removed from the usable habitat volume, and placed in the walls by way of a radiation shielding water wall. It would also provide a mechanism to recover and reuse water treatment (solids) residuals to strengthen the habitat shell and a method of deriving radiation shielding from wastes generated on orbit.

Water Walls Integrated Module

Humidity and Thermal Control

Proton Exchange Medium

Algae Growth

Blackwater (solid waste) Processing

Urine and Graywater Processing

Revitalization

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Project Image Water Walls: Highly Reliable and Massively Redundant Life Support Architecture

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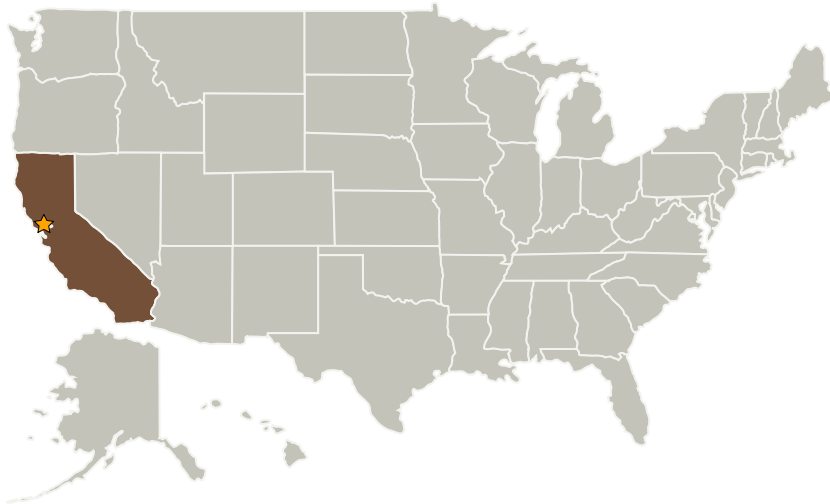
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Astrostructure	Supporting Organization	Industry	
Bay Area Environmental Research Institute(BAER)	Supporting Organization	R&D Center	Moffett Field, California
Desert Toad LLC	Supporting Organization	Industry	
Universities Space Research Association(USRA)	Supporting Organization	R&D Center	Huntsville, Alabama

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Ames Research Center (ARC)

### Responsible Program:

NASA Innovative Advanced Concepts

## Project Management

### Program Director:

Jason E Derleth

### Program Manager:

Eric A Eberly

### Principal Investigator:

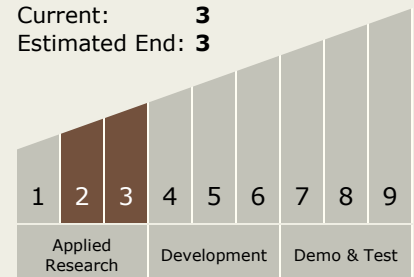
Michael Flynn

## Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3



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## Primary U.S. Work Locations

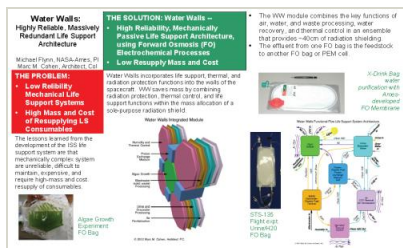
California

## Project Transitions

**September 2012:** Project Start**June 2013:** Closed out

**Closeout Summary:** The Water Wall concept proposes a system for structural elements that provide, thermal, radiation, water, solids and air treatment functions which are placed at the periphery of inflatable or rigid habitats. It also provides novel and potentially game changing mass reduction and reuse options for radiation protection. The approach would allow water recycling, air treatment, thermal control, and solids residuals treatment and recycling to be removed from the usable habitat volume, and placed in the walls by way of a radiation shielding water wall. It would also provide a mechanism to recover and reuse water treatment (solids) residuals to strengthen the habitat shell and a method of deriving radiation shielding from wastes generated on orbit. Water wall treatment elements would be a much-enlarged version of the commercially available hydration bags. Some water bags may have pervaporation membranes facing outward, which would provide the ability to remove H<sub>2</sub>O, CO<sub>2</sub> and trace organics from the atmosphere and some would have hydrophobic internal membranes which would provide water, and waste recycling and some power generation.

## Images

**11551-1366047892756.jpg**

Project Image Water Walls: Highly Reliable and Massively Redundant Life Support Architecture  
(<https://techport.nasa.gov/image/102135>)

## Technology Areas

### Primary:

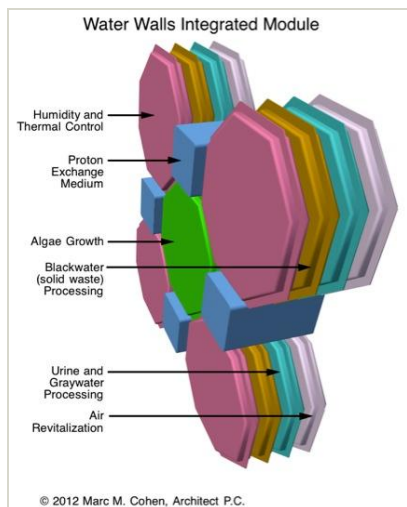
- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - ↳ TX12.3 Mechanical Systems
  - ↳ TX12.3.5 Certification Methods

## Target Destinations

Earth, The Moon, Mars

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**11551-1366739451459.jpg**

Project Image Water Walls: Highly Reliable and Massively Redundant Life Support Architecture  
(<https://techport.nasa.gov/image/102314>)